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Comparative Evaluation of Clinical Findings in Temporomandibular Joint Pathology with Magnetic Resonance Imaging – A Cross-sectional Study

Yogesh Yadav[1], Vishram Singh[2], Hema Puranik A.R[3]*, Chandrakala Agarwal[4]

Abstract

Background: Temporomandibular disorders (TMDs) are broad group of clinical problems involving the masticatory musculature, the temporomandibular joint (TMJ), and the surrounding hard and soft-tissue components or combination of these problems. It can also be secondary to muscle hyperfunction or parafunction, traumatic injuries, hormonal influences, and articular changes within the joint. Magnetic resonance imaging (MRI) is currently considered as the preferred method for imaging the soft-tissue structures of the TMJ and has been pointed out as the best imaging modality in diagnosing disc displacements. **Aim:** The aim of this study is to comparatively evaluate the clinical findings of temporomandibular pathology with the MRI. **Methodology:** This is a cross-sectional observational study with comprised multiethnic group. A total of 50 patients reporting to the dental OPD with TMJ pathology were selected. These subjects underwent thorough clinical examination of TMJ and MRI of the TMJ was taken for all the individuals and parameters such as change in disk position, condylar surface, and effusion were recorded with the help of the radiologist. **Statistical Data Analysis:** Statistical presentation and analysis of the present study were done using the *P* value and Chi-square test by SPSSV20. **Results:** The results obtained in this study showed that out of 50 individuals, pain was present only in 28, that is, 56% of population other complaints of jaw deviation, clicking sound, and restricted mouth opening. Disc displacement was found only in 57.14% of symptomatic individual and 72.72% of asymptomatic individuals. MRI revealed pain and effusion was present only in 28% of symptomatic patients. About 76% of the subjects had jaw deviation while mouth opening out of which 68.42% showed disc displacement in MRI. About 56% of the subjects had positive history of trauma out of which 50% showed disc displacement in MRI. About 56% of the subjects reported with the clicking sound out of which 64.28% showed disc displacement in MRI. **Conclusion:** TMJ is one of the complex joints in the entire body. Because of this complexity of the TMJ, the pathologies as well as normal anatomical patterns must be known before any diagnosis. The selection of the proper radiological technique for TMJ, as well as of the patient, must be carefully made by the practitioner, in correlation with the clinical signs and symptoms. MRI is the diagnostic study of choice for evaluation of disk position and internal derangement of the joint. Although already many studies had been done on MRI, such type of studies should be conducted on large scale in future based on specific parameters for early diagnosis and treatment planning for patients suffering with TMD to provide quality treatment to the patients at initial stage.

Keywords: Temporo mandibular joint, Temporo mandibular disorder, Disc dislocation, Condylar head surface, Effusion

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Introduction

Temporomandibular joint (TMJ) is a complex synovial joint controlled by a neurological controlled mechanism.[1] Masticatory system conducts mastication, speech, and deglutition. Improper coordination of the system alters muscle behavior and causes injury to its components.

The articular disc is a distinct component of the TMJ articulating with temporal bone and the condyles. Improper muscle movement and mobility, compromised articular disc movement leads to TMJ dysfunction.[2]

Magnetic resonance imaging (MRI) produces magnetic field and radiofrequency pulses resulting in multiple digital image slices. It is non-invasive and can assess disc, muscles, and joint effusions (JEs).[3]

Aims and Objectives

The objectives of the study were as follows:

- To evaluate the correlation between the clinical findings and MRI of TMJ with pathology.
- To clinically evaluate TMJ pathologies such as pain, deviation on mouth opening, trauma, and disc displacement and to interpret with MRI.

[1]Department of Anatomy, Santosh Medical College, Santosh Deemed to be University, Ghaziabad, Uttar Pradesh, India

[2]Department ofAnatomy, Adjunct Visiting Faculty, Kasturba Medical College, MAHE University, Mangaluru, Karnataka, India

[3]Department of Medical Anatomy, Sri Siddhartha Medical College , SAHE University, Bengaluru, Karnataka, India

[4]Department of Anatomy, SMS Medical College, Jaipur, Rajasthan, India

Corresponding Author: Dr. Hema Puranik A.R, Department of Medical Anatomy, 12, Ashraya, Syndicate Bank Colony, Magadi Main Road, Bengaluru - 560 079, Karnataka, India. E-mail: hemprakudva@gmail.com

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Methodology

The study was conducted among the outpatients visiting Department of Periodontology, Jaipur Dental College complaining of TMJ problems or diagnosed to have TMJ problems.

Research Design and Study Population

The purpose of research was to develop any correlation between the clinical findings with MRI finding of TMJ with pathology. A formal ethical clearance to conduct this study was obtained from the ethical committee of the institution. The study was a cross-sectional observational study comprising multiethnic groups. Fifty subjects reporting to the OPD with history of pain in TMJ region and who met the inclusion and exclusion criteria were selected.

Inclusion Criteria

The following criteria were included in the study:

1. Patients in age group between 25 and 40 years.
2. Patients with TMJ pain during palpation or function.
3. Patients with restricted mouth opening.
4. Patients with U/L or BIL clicking observed from the past 6 months.
5. Patients with no history of developmental anomaly.
6. Patients with no systemic illness.

Exclusion Criteria

The following criteria were excluded from the study:

1. Patients with recent history of ear infection.
2. Patients with myofascial muscle problem only.
3. Patients who give a history of claustrophobia and is uncooperative.
4. Patients who were pregnant or with pace makers, aneurysm clips, partial dentures, hearing aids, metallic implants, and crowns.

Patients selected for the study were explained in detail about the condition affecting their oral cavity and the investigations they would be subjected to. A written informed consent was sought from all of the subjects.

MRI of TMJ was advised. The MRI was assessed for changes in the disk position, condylar surface, and sign of effusion with the help of radiologist.

Method of Collection of Data

Data collection included (1) detailed history with special focus on the following factors such as duration of TMJ problem, habits, and stress, (2) clinical examination, and (3) MRI examination.

Extraoral Examination

Extraoral examination for TMJ included thorough inspection for facial asymmetry, muscle hypertrophy, opening pattern, especially for corrected or uncorrected deviation, limitation in movement, and palpation and auscultation.

Palpation by intra-auricular and extra-auricular method was done for all muscles of mastication.

Range of mandibular movements was assessed with the divider and scale.

Ausculation of TMJ was done to appreciate any TMJ sounds.

Intraoral Examination

Intraoral examination was done to assess dentition status of the patients, signs of parafunctional habit (attrition, and bruxism), cheek biting, and habit of unilateral chewing.

MRI

Bilateral TMJ MR images were obtained even though the patient complained only in one joint so that other joint images were used for comparison. MR images were taken by means of 1.5 T MR scanners (GE Scanner) and a dedicated circular polarized transit and receive head coil for TMJ. The data were collected on a 256 × 192 matrix with a field view of 12 mm. Axial localizing images were taken from which the sagittal and coronal planes were described. The maximum intercuspation position was used for close mouth images. After the closed mouth image was obtained, the patient was instructed to open the mouth as wide as possible to obtain reduction of a displaced disc. Pulse sequence were obtained on sagittal and coronal T1-weighted images, T2-weighted images, proton density images, and gradient echo weighted images.

The position of the disc was diagnosed by a single radiologist and same MR unit for all the patients as there would be less variation. The position of disc was diagnosed as follows:

- Normal: When the disc was located superior to the condyle both in closed and open mouth position.
- Disc displacement with reduction: When the disc was displaced at the closed mouth position and in the normal position in the open mouth images.
- Disc displacement without reduction: When the disc was displaced in both the closed and open mouth positions.

On T1-weighted images, normal anatomy was identified and disc position on sagittal and coronal plane. On T2-weighted images, JE was identified as an area of high signal intensity in the region of the upper or lower joint spaces.

Statistical Analysis

Statistical presentation and analysis of the present study were done using the *P* value and Chi-square test by SPSSV20.

Results and Observation

The results obtained in this study showed that out of 50 individuals, pain was present only in 28, that is, 56% of population other complaints of jaw deviation, clicking sound, and restricted mouth opening. Disc displacement was found only in 57.14% of symptomatic individual and 72.72% of asymptomatic individuals. MRI revealed pain and effusion was present only in 28% of symptomatic patients. About 76% of the subjects had jaw deviation while mouth opening out of which 68.42% showed disc displacement in MRI. About 56% of the subjects had positive history of trauma out of which 50% showed disc displacement in MRI. 56% of the subjects.

Table 1 depicts that the out of 50 patients, the number of male patients was 22 and numbers of female patients were 28. The mean age of male patients was 32.63 years and female patients was 31.85 years. No statistically significant difference was seen between male and female patients.

Table 2 depicts that the most common chief complaint was pain in 56% of patients and only 44% of patients having chief complaint other than pain like noise in front of ear while mastication or restricted mouth opening.

Table 3 represents that 20% of patients had pain on right side, 16% of patients had on left side, and 36% had pain occurred bilaterally.

Table 4 shows that 10 patients (20%) had eroded changes out of that 6 (21.42%) patients were positive pain history. Forty patients had no bony changes in changes (normal) out of which 22 patients (78.57%) were positive with a history of pain.

Thus, no statistically significant correlation between eroded changes and chief complaint of pain.

Table 1 : Distribution according to age & sex of the patients

Age group (yrs)	*Sex*		*Total*
	Male	*Female*	
25-30 yrs	4 (18.18%)	12 (42.85%)	16 (32%)
30-35 yrs	12 (54.54%)	6 (21.42%)	18 (36%)
35-40 yrs	6 (27.27%)	10 (35.71%)	16 (32%)
Total	22 (44%)	28 (56%)	50 (100%)

Chi square test= 6.3718 P-value=0.04134

Table 2: Distribution of Chief complaint of the patients

Chief complaint	*No.*	*Percentage*
Pain	28	56%
Other	22	44%
Total	50	100%

Table 3: Distribution of pain in the patients

Pain	*No.*	*Percentage*
Right side	08	16%
Left side	04	08%
Bilateral	16	32%
No	22	44%
Total	50	100%

Table 4: Distribution according to Hard tissue changes in MRI & chief complaint of patient

Hard tissuen changes in MRI	*Chief complaint of pain*		*Total*
	Present	*Absent*	
Eroded	06 (21.42%)	04 (18.18%)	10 (20%)
Normal	22 (78.57%)	18 (81.82%)	40 (80%)
Total	28 (56%)	22 (44%)	50 (100%)

Chi square test= 0.0812 P-value= 0.775

Table 5: Distribution according to Effusion in MRI & chief complaint of pain

Effusion in MRI	*Chief complaint of pain*		*Total*
	Present	*Absent*	
Mild	08 (28.57 %)	06 (27 .27%)	14 (28 %)
Normal	20 (71.43)	16 (72.73%)	36 (62 %)
Total	28 (56%)	22 (44%)	50 (100%)

Chi square test = 0.0103 P-value= 0.9191

Table 5 depicts that 14 patients (28%) had effusion out of that 8 (28.57%) patients were positive pain history. Thirty-six patients had no sign of effusion (normal) out of which 20 patients (71.43%) were positive pain history. Thus, no statistical significant correlation between effusion and chief complaint of pain.

Table 6 depicts that the 16 patients had abnormal disc position with positive pain history. Twenty-two patients had no pain history out of which 16 patients had abnormal disc position in MRI.

Discussion

The TMJ is a ginglymoarthrodial synovial joint (Latin: Ginglymus = hinge joint) that allows both backward and forward translation as well as a gliding motion.[4] Temporomandibular disorders (TMDs) are a broad group of clinical problems involving the masticatory musculature, the TMJ, surrounding bony and soft-tissue components, and combinations of these problems.[5]

MRI could detect the early signs of TMJ dysfunction, such as thickening of anterior or posterior band, rupture of retrodiscal tissue, changes in shape of the disc, and JE. This study was done to know whether there is any correlation between clinical signs and symptoms of TMJ disorders with that of changes of joint as observed in MRI.

Results of the study showed the mean age of male patients was 32.63 years and female patients was 31.85 years. No statistically significant difference was seen between male and female patients. Results of our study showed that the prevalence increases as age advances. Lipton *et al*.,[6] Pedroni *et al*. (2004),[1] and Kumar *et al*. (2015)[7] showed that patients with TMD symptoms present over a broad age range; however, there is a peak occurrence between 20 and 40 years of age.[8]

Yap *et al*. (2003)[9] suggested that there is possible link between gender and age distribution in TMD.

Analyzing the results, slight female predilection was seen which was not statistically significant. The previous studies done by Rugh *et al*. (1985)[10] found prevalence in women with ratio between women and men for TMJ disorder at 8:1. Nekora-Azak (2004)[11] and Pedroni *et al*. (2003)[12] suggested that the female reproductive hormones play an etiological role in TMD as age advances. Pedroni *et al*. (2003)[12] suggested that high prevalence of TMD in women may be related to difference in muscular structure. The previous studies have noted in TMD patients, symptoms are mostly pronounced between the age of 20–40 years.[13,14]

Our study showed that symptoms of pain were present in 28 (56%) patients and only 44% of patients had chief complaint other than pain like noise in front of ear while mastication or restricted mouth opening. Out of 28 patients, 10 (20%) patients had pain on right side, 8 (16%) patients had on left side, and 18 (36%) had pain occurred bilaterally. The results go in agreement

Table 6: Distribution according to Disk position & chief complaint of pain

Chief complaint	*Disc position*						
	ADDR			*ADDWR*			*Normal*
	Right	*Left*	*Total*	*Right*	*Left*	*Total*	
Present	10	06	16	03	05	08	12
(N=28)	(35.71%)	(21.74%)	(57.14%)	(10.71%)	(17.85%)	(28.57%)	(42.85%)
Absent	01	03	04	01	03	04	06
(N=22)	(4.54%)	(13.63%)	(18.18%)	(4.54%)	(13.63%)	(18.18%)	(27.27%)
Total	11	09	20	04	08	12	18
(N=50)	(22%)	(18%)	(4%)	(8%)	(16%)	(24%)	(36%)

with a study done by Kumar *et al*. (2015)[7] who studied TMD subjects with the disorder affecting either of the joints as well bilateral involvement.

Truta *et al*. (1990) suggested that TMJ disorders comprising of myofascial pain and dysfunction may be included in the broad group of nonspecific generalized muscular aches and pains affecting other muscle groups in the body.[15]

In our study, MRI changes were evaluated for disc displacement and results noted that disc displacement was present in 57.14% of asymptomatic patients and 72% of symptomatic patients. In our study, more number of symptomatic subjects presented with anterior disc displacement in MRI. The results are in agreement with Maizlin *et al*. (2010)[16] and Kumar *et al*. (2015)[7] study who found disc displacement prevalence in symptomatic subjects. The results are in concurrence with a study by Tomas *et al*. (2006)[2] who stated that disk location is of prime importance and displaced disk is a critical sign of TMJ dysfunction.

The findings of the study note that TMJ disc displacement cases complained of TMJ pain as well as stated by Katzberg *et al*. (1996)[17] who reported that pain was a characteristic symptom for disk displacement.

Kumar *et al*. (2015)[7] concluded that disk displacement on MRI correlated well with the presence of clinical signs and symptoms of TMD.

Campos *et al*. (2008)[18] suggested that TMJ pain was more frequent in the presence of degenerative bony changes.

Our study showed no correlation between the presence of pain and the MRI detection of effusion. Both pain and effusion were seen only 14/50 (28.57%) of symptomatic patients. The results are in concurrence with study of Murakami *et al*. (1996) and de Oliveira *et al*. (2013)[19,20] wherein JE was reported in very small percentage of TMD. They attributed bone changes in the head of the mandible to be associated with the presence of JE.

In our study, 68.42% of subjects showed disc displacement in MRI.

The results are in accordance with Katzberg *et al*. (1996)[17] who found MRI evidence of disk displacement in 84% of symptomatic patients with TMD versus 33% of asymptomatic patients.

In our study, 56% of subjects had positive history of trauma with majority of them showing disc displacement in MRI. The results are in accordance with study of Tanaka and van Eijden *et al*. (2003)[21] who stated trauma alters the mechanical properties of the disc and causes mechanical fatigue of the disc.

Another study done by Manfredini *et al*. (2011)[8] suggested trauma causes inflammatory reaction in the retrodiscal structures and an injury to the temporomandibular ligament which predisposes to disc displacement.

Pullinger *et al*.[22] applied multiple factor analysis, which indicated the low correlation of occlusion to TMD.

Pullinger *et al*.[22] further estimated that occlusal factors contribute about 10–20% to the total spectrum of etiological factors which differentiates between healthy persons and patients with TMJ disorders.

Our study showed that 56% of subjects presented with clicking. Out of that, 64.28% of subjects showed disc displacement in MRI. However, with clicking as clinical finding, MRI shows more prevalence for ADDWR than ADDR.

Huddleston *et al*. (2004) revealed that disturbed structural relationship between the disc and condyle is restored during mandibular movement and this restoration is manifested as clicking sound.

Yang *et al*. (2017)[23] concluded that MRI can be successfully used to evaluate multiple morphological changes at different mouth positions of normal volunteers and patients. The disc-condyle relationship can serve as an important indicator in assessing anterior disc displacement, and can be used to distinguish disc displacement with or without reduction.

Katzberg *et al*. (1979)[24] revealed that common symptoms of a reducing disk are a reciprocal clicking of the TMJ whereas DD without reduction frequently limits mandibular mobility.

Miller *et al*. (1985)[25] suggested that cause of clicking sound is a frictional impact between the degenerated surface of condyle.

Sener and Akgänlü (2004)[26] concluded that degenerative changes and effusion did not appear to be markers of either ADDR or ADDWR. The prevalence of sideways displacement, disc deformation, signal intensity changes, scar tissue, and osteonecrosis was greater in ADDWR than ADDR.

Summary and Conclusion

TMJ being anatomically complex joint produces greater challenges for clinician to arrive at accurate clinical diagnosis. Hence, in-depth knowledge regarding the anatomy and physiology of the TMJ is required before obtaining final diagnosis of TMJ pathology. Selection of proper imaging modality is also critically important to correlate with clinical findings to get proper diagnosis of TMD. MRI is one such imaging modality to evaluate complex TMJ pathologies.

Based on the observations of our study, it was seen that MRI is the gold standard for visualizing the soft-tissue deformities surrounding TMJ. The clinical findings of TMJ pathologies were also well correlated with the findings obtained from the MRI. Henceforth, studies using MRI with larger sample must be conducted in diagnosis of complex TMJ pathologies to arrive at the early diagnosis and to provide necessary treatment at the earliest.

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